

Claims

We claim:

1. A network monitoring system comprising a network router with built-in monitoring data gathering, the network router including:

channels through which data pass in packets, each of the packets including a packet header;

5 a header copier that generates a header copy from the packet header of at least some of the packets; and

a packet generator that receives the header copies and forms monitoring data packets therefrom, each of the monitoring data packets additionally representing temporal data relating to the header copies included therein.

2. The network monitoring system of claim 1, in which:

the network router additionally includes a time stamp generator that generates time stamps; and

5 the packet generator additionally receives the time stamps and inserts at least one of the time stamps into each of the monitoring data packets as part of the monitoring data.

3. The network monitoring system of claim 2, in which the packet generator inserts into each of the monitoring data packets one of the time stamps for each of the header copies included therein as part of the monitoring data.

4. The network monitoring system of claim 1, in which the packet generator forms each one of the monitoring data packets from the header copies received during a predetermined interval of time to provide the temporal data.

5 5. The network monitoring system of claim 4, in which:
the network router additionally includes a time stamp generator that generates time stamps; and
the packet generator forms each one of the monitoring data packets from the header copies received during a predetermined interval of time and additionally receives the time stamps and inserts one of the time stamps into each of the monitoring data packets, the predetermined interval of time and the predetermined interval of time collectively constituting the temporal data.

6. The network monitoring system of claim 1, in which the header copier generates a header copy from the packet headers of all of the packets.

7. The network monitoring system of claim 1, in which:
each of the channels includes a packet processing engine that packages packets in envelopes for passage through the network router to another of the channels;

the packet generator passes the monitoring data packets to the packet processing engine, which packages the monitoring data packets in envelopes addressed to one of the channels;

the envelopes containing the monitoring data packets pass through the network router to the one of the channels to which they are addressed;

the network monitoring system additionally comprises a monitoring data processor connected to the one of the channels to which the envelopes containing the monitoring data packets are addressed, the monitoring data processor including a data base engine that operates to build a data base from the monitoring data received in the monitoring data packets.

8. The network monitoring system of claim 7, in which the monitoring data processor is connected to the channel of the router by the network.

9. The network monitoring system of claim 1, in which:
the network router additionally includes:

in each of the channels, a packet processing engine that packages
packets in envelopes for passage through the network router to another
of the channels, and

a monitoring data processor configured to appear as an
additional one of the channels, the monitoring data processor including
a data base engine that operates to build a data base from the
monitoring data received in the monitoring data packets;

the packet generator passes the monitoring data packets to the packet
processing engine, which packages the monitoring data in envelopes addressed
to the monitoring data processor; and

the envelopes containing the monitoring data packages pass through
the network router to the monitoring data processor.

10. The network monitoring system of claim 1, additionally comprising
a monitoring data processor connected to receive the monitoring data packets
and including a data base engine that operates to build a data base from the
monitoring data included in the monitoring data packets.

11. The network monitoring system of claim 10, in which the
monitoring data processor additionally includes an analysis engine for
analyzing the monitoring data in the data base to generate performance data
relating to the network router.

12. The network monitoring system of claim 10, in which:
the network router is a first network router and is connected to a
network that includes at least one second network router with built-in
monitoring data gathering;

- 5 the monitoring data processor additionally includes:
a communications port connected to receive additional data
from the at least one second network router, the additional data
including at least one of (a) monitoring data and (b) performance data,
and
10 an analysis engine that analyzes the monitoring data and the
additional data to generate performance data relating to performance of
the network.

13. The network monitoring system of claim 12, in which the analysis
engine additionally operates to identify ones of the monitoring data and the
additional data including headers having identical source and destination
addresses, and generates the performance data from the identified ones of the
5 monitoring data and additional data, the performance data generated relating
to the performance of a connection through the network between the source
and destination.

14. The network monitoring system of claim 10, in which the
monitoring data processor is a first monitoring data processor and additionally
includes a communications port configured to feed at least one of (a) the data
base and (b) performance data generated at least in part from the data base to
5 a second monitoring data processor.

15. The network monitoring system of claim 14, in which the
communications port is connected to the network.

16. The network monitoring system of claim 14, in which the first monitoring data processor and the second monitoring data processor are elements of a hierarchical structure of monitoring data processors.

17. A method of obtaining performance data relating to a data transmission network including a node, the method comprising:

passing data through the node in packets, each of the packets including a packet header;

5 copying at least some of the packet headers to obtain respective header copies as monitoring data;

forming monitoring data packets from the monitoring data, the monitoring data packets additionally representing temporal data relating to the header copies included therein;

10 transmitting the monitoring data packets; and

generating the performance data from the monitoring data contained in the monitoring data packets.

18. The method of claim 17, in which, in transmitting the monitoring data, the monitoring data packets are transmitted within the node.

19. The method of claim 17, in which, in transmitting the monitoring data, the monitoring data packets are transmitted through the network.

20. The method of claim 17, in which generating the performance data includes:

building a data base of the monitoring data received in the monitoring data packets; and

5 analyzing the monitoring data in the data base to generate the performance data.

21. The method of claim 15, additionally comprising transmitting at least one of (a) the data base and (b) performance data derived at least in part from the data base to at least one other node of the network.

22. The method of claim 15, in which generating the performance data includes performing hierarchical processing of data bases and performance data received from nodes of the network.

23. The method of claim 17, in which, in generating the performance data, the monitoring data are analyzed to generate performance data relating to performance of the node.

24. The method of claim 17, in which generating the performance data includes:

5 receiving additional data relating to at least one additional node in the network, the additional data including at least one of monitoring data and performance data; and

analyzing the monitoring data and the additional data to generate the performance data, the performance data generated relating to performance of the network.

25. The method of claim 24, in which analyzing the monitoring data and the additional data includes:

5 identifying ones of the monitoring data and the additional data including headers having identical source and destination addresses; and
generating the performance data from the identified ones of the monitoring data and the additional data, the performance data relating to performance of a connection through the network between the source and destination.

26. The method of claim 17, additionally comprising controlling operation of the node in response to the performance data.

27. The method of claim 17, additionally comprising:
generating billing data from the performance data; and
billing a customer using the billing data.

28. The method of claim 17, additionally comprising:
generating time stamps; and
inserting at least one of the time stamps into each one of the
monitoring data packets.

29. The method of claim 28, in which, in inserting at least one of the
time stamps into each one of the monitoring data packets, one of the time
stamps is inserted for each of the header copies included therein.

30. The method of claim 17, in which, in forming monitoring data
packets from the monitoring data, each one of the monitoring data packets is
formed from the header copies made during a predetermined time to provide
the temporal data.

31. The method of claim 30, additionally comprising:
generating time stamps; and
inserting one of the time stamps into each one of the monitoring data
packets.

32. The method of claim 17, in which, in copying at least some of the
packet headers, all the packet headers are copied.